GATES LEARJET CORPORATION

maintenance manual

CHAPTER

73

ENGINE FUEL & CONTROL

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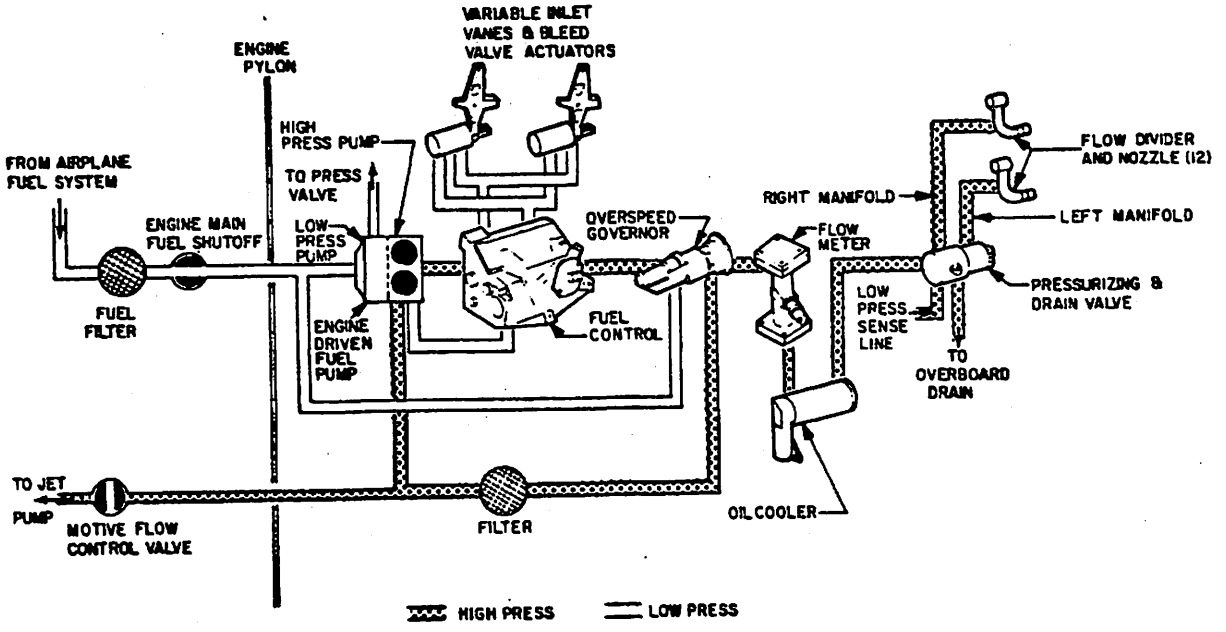
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GENERAL - DESCRIPTION AND OPERATION

1. General
 A. This chapter contains information pertaining to the fuel supply lines, fuel pressure, fuel pressure relief and fuel flow indicating systems.
 B. For information pertaining to the fuel control, fuel manifold and fuel nozzles, refer to Engine Maintenance Manual.

2. Description
 A. Fuel is supplied to each engine from the fuel tank pumps, through the fuel filters, and engine main fuel shutoff valves located in the tailcone area. Fuel lines are routed from the tailcone area into the engine pylons to the low pressure side of the dual element engine-driven pumps mounted on the right forward side of the engine. The low pressure boost stage charges the positive displacement gear pump, which in turn provides high pressure fuel to the fuel control. The fuel control is a hydromechanical unit mounted on the pump which provides a positive shutoff of fuel to the engine and automatically meters fuel to the combustion chamber for different operating conditions such as changes in power setting, ambient temperature, and pressure. The fuel control also regulates fuel flow to the variable inlet vanes and bleed valve actuators during transient and steady state engine operation. Fuel is routed to the combustion chamber from the fuel control and passes through the overspeed governor located at the forward centerline of the engine. Engine overspeed is prevented by bypassing fuel through the overspeed governor. Fuel passes from the overspeed governor to the flowmeter, located forward of the oil cooler, and provides an electrical signal to the fuel flow indicator on the instrument panel. Fuel passes from the flowmeter to the oil cooler mounted in the recess of the oil tank and provides engine oil cooling. A fuel line is connected from the oil cooler to the pressurizing and drain valve located at the 6 o'clock position on the compressor case. The pressurizing section of the valve maintains a back pressure on the fuel control to insure proper fuel pressure on the fuel control servos and variable inlet vanes and bleed valve servos during a low fuel flow condition. Two fuel manifolds, connected to the pressurizing valve, distribute fuel to the flow dividers and fuel nozzles located on the main frame of the engine. The fuel nozzles provide the correct spray pattern of metered fuel flow to the combustion chamber. The drain section of the pressurizing and drain valve permits draining of fuel from the nozzles and manifolds when the engine is shut down. This fuel, on aircraft 25-186 and Subsequent and aircraft incorporating AAK74-8, is drained into a collector tank at the forward side of the starter-generator gearbox. The fuel drain collector tank is to be drained into a suitable container after every third engine shutdown.

The collector tank drain valve is located adjacent to the nacelle cluster drain opening. There are three additional filters in the fuel system. The overspeed governor filter, mounted on a bracket attached to the overspeed governor; the fuel pump filter, internally in the fuel pump and the fuel control filter installed in the fuel control. A motive flow line is connected to the high pressure side of the engine-driven pump. When the motive flow control valve, located in the tailcone area, is opened, high pressure fuel is directed through the jet pumps drawing fuel from the tank.



Engine Fuel System Schematic
Figure 1

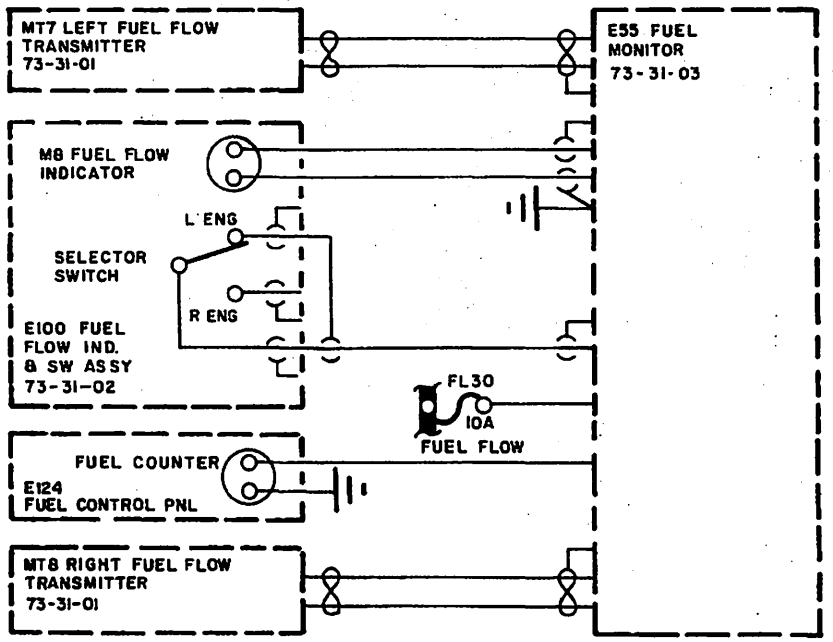
FUEL FLOW INDICATING - DESCRIPTION AND OPERATION

1. Description

A. The engine fuel flow indicating system consists of a fuel flow transmitter located on each engine, a fuel monitor printed circuit board located in the fuel control box in the tailcone, a fuel flow indicator located on the instrument panel. The system is powered by 28 vdc supplied through a 20-ampere current limiter.

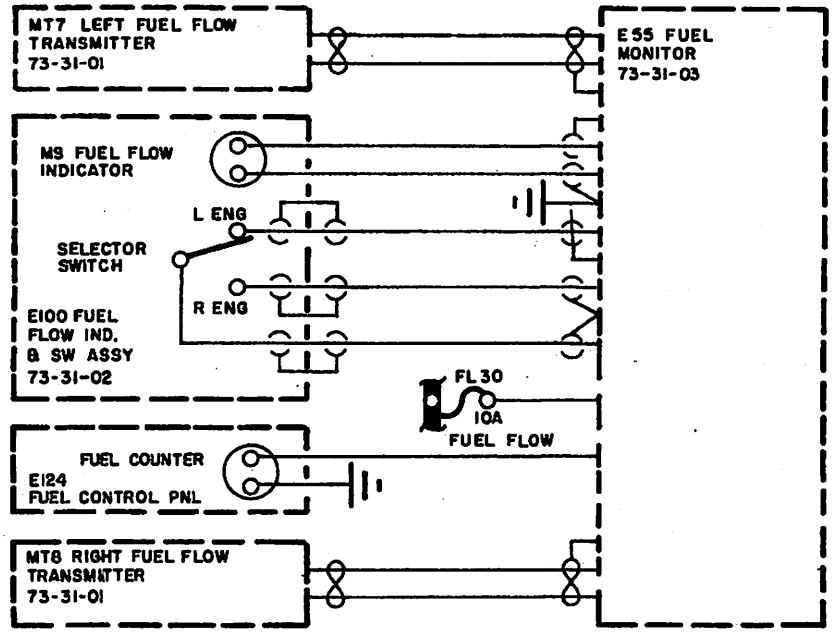
2. Operation (See figure 1.)

A. The transmitters measure fuel flow by means of a rotor-turbine assembly in each engine fuel line. An increase or decrease in fuel flow causes the rotor-turbine assembly speed to increase or decrease. A pickup coil sensing device converts any change in electromagnetic flux, caused by the rotating rotor-turbine assembly, into alternating voltage. This alternating voltage is applied to the fuel monitoring circuit and converted into DC electrical signals. On Aircraft 25-061, 25-070 thru 25-230, the DC electrical signals are applied to the single pointer fuel flow indicator through a switch labeled L and R. On Aircraft 25-231 and Subsequent, the DC electrical signals are applied to a dual pointer fuel flow indicator. In addition, these electrical signals are applied to the fuel counter system, when installed.

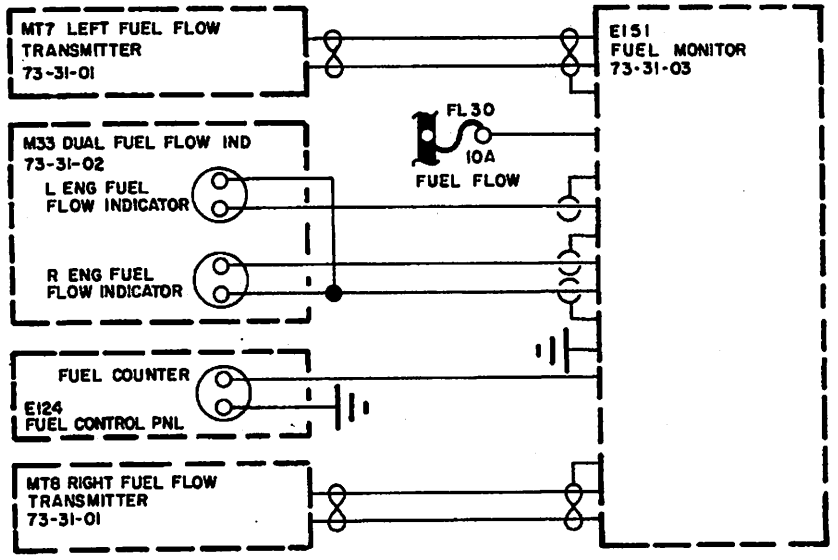


Aircraft 25-061 and 25-070 thru 25-106

Fuel Flow Electrical Control Schematic
Figure 1 (Sheet 1 of 2)



Aircraft 25-107 thru 25-230



Aircraft 25-231 and Subsequent

Fuel Flow Electrical Control Schematic
Figure 1 (Sheet 2 of 2)

FUEL FLOW INDICATING - MAINTENANCE PRACTICES

1. Adjustment/Test

A. Functionally Test Fuel Flow Indicating System with Dual Pointer Indicator (See figure 201.)

(1) Tools and Equipment

NOTE: Equivalent substitutes can be used in lieu of the following.

NAME	NUMBER	MANUFACTURER	USE
Audio Oscillator	200 C-D	Hewlett-Packard	Simulate fuel flow.
Voltmeter	400 D	Hewlett-Packard	Monitor voltage of audio oscillator.

(2) Remove engine lower nacelle from LH and RH engines.

(3) Disconnect electrical connector from each fuel flow transmitter.

(4) Connect one lead from audio oscillator to pin A of LH and RH connectors.

(5) Connect one lead from audio oscillator to pin B of LH and RH connectors.

(6) Connect voltmeter so as to monitor voltage supplied by audio oscillator.

(7) Apply 28 vdc to aircraft.

(8) Adjust audio oscillator to frequency and voltage as shown in figure 201 and check LH and RH fuel flow pointers at same time for indication shown ±5 percent. Difference in fuel flow between left and right shall not exceed 50 pounds.

FREQUENCY	VOLTAGE	INDICATION
36 HZ	1.0 v	1000 pounds
53 HZ	1.0 v	1500 pounds
71 HZ	1.0 v	2000 pounds
106 HZ	1.0 v	3000 pounds

Fuel Flow Indicating System Test
Figure 201

(9) Remove electrical power from aircraft.
(10) Disconnect test equipment.
(11) If indications did not fall within stated tolerances, check continuity of wiring. When wiring is correct perform Functional Test of Dual Pointer Fuel Flow Indicator. (Refer to 73-31-02.)
(12) Connect electrical connector to each fuel flow transmitter and install safety wire.
(13) Install engine lower nacelle on each engine.

FUEL FLOW TRANSMITTER - MAINTENANCE PRACTICES

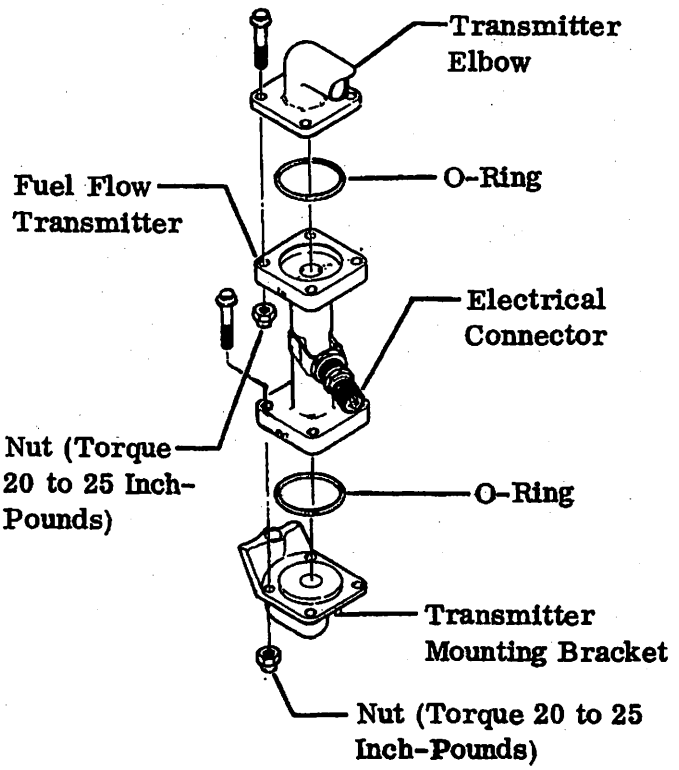
1. Removal/Installation

A. Remove Fuel Flow Transmitter (See figure 201.)

(1) Remove engine lower nacelle.
(2) Place suitable container under transmitter to catch any fuel in lines.
(3) Disconnect fuel lines from transmitter.
(4) Disconnect electrical connector from transmitter.
(5) Remove attaching parts and transmitter from engine.

B. Install Fuel Flow Transmitter (See figure 201.)

(1) Use new O-ring when installing transmitter.
(2) Install transmitter and O-rings on engine. Secure with attaching bolts and nuts. Torque nuts 20 to 25 inch-pounds.
(3) Connect electrical connector to transmitter.
(4) Install engine lower nacelle.



Fuel Flow Transmitter Installation
Figure 201

FUEL FLOW INDICATOR - MAINTENANCE PRACTICES

1. General
 A. The fuel flow indicator is installed in the engine instrument panel. The indicator shows fuel flow in lbs/hr x 1,000.
 B. On Aircraft 25-061 and 25-070 thru 25-230, the indicator is a single pointer instrument. The indicator will read fuel flow of either the right engine or the left engine by setting the switch adjacent to the indicator to either R or L.
 C. On Aircraft 25-231 and Subsequent, the indicator is a dual pointer instrument. The pointers are labeled L and R and indicate fuel flow of the respective engine.

2. Removal/Installation

 NOTE: The indicator is secured by a clamp which incorporates a self-tightening action. One screw holds the clamp to the panel, while the remaining screw tightens the clamp.

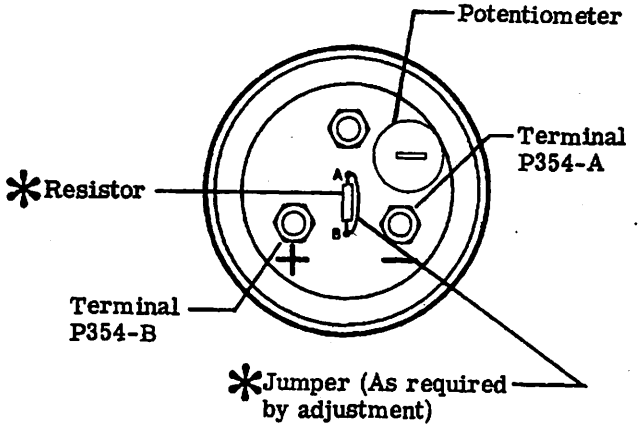
 A. Remove Fuel Flow Indicator
 (1) Loosen screw and clamp.
 (2) Pull indicator from panel.
 (3) Disconnect electrical plug.
 B. Install Fuel Flow Indicator
 (1) Connect electrical plug to indicator.
 (2) Position indicator in panel.
 (3) Secure indicator by tightening clamp screw.

3. Adjustment/Test
 A. Calibrate Fuel Flow Indicator (Aircraft 25-070 thru 25-230) (See figure 201)

 NOTE: On Aircraft 25-061 and 25-070 thru 25-119, the indicator assembly has a resistor and jumper wire between points A and B. On Aircraft 25-120 thru 25-230, the resistor and jumper have been deleted and indicator adjustment is accomplished by adjusting the potentiometer.

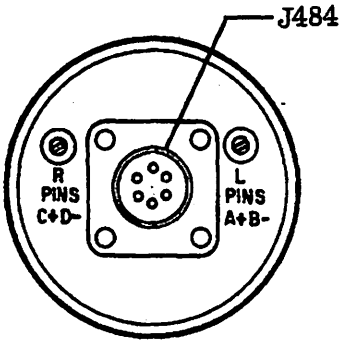
 (1) Apply a voltage of 1.19 vdc across terminals P354-B(+) and P354-A(-).
 (2) Adjust potentiometer to obtain full scale deflection on the indicator.

 NOTE: If, on Aircraft 25-070 thru 25-119, full scale deflection cannot be obtained, clip the jumper wire (A-B) and repeat steps (1) and (2).
 Replace indicators which will not adjust for full scale deflection.



* Resistor and Jumper effective 25-070 thru 25-119 only.

Aircraft 25-070 thru 25-230



Aircraft 25-231 and Subsequent

Fuel Flow Indicator Adjustment
Figure 201

B. Functional Test of Dual Pointer Fuel Flow Indicator (Aircraft 25-231 and Subsequent) (See figures 201 and 202.)

(1) Remove fuel flow indicator from instrument panel. (Refer to Removal/Installation.)

(2) Connect negative (-) power supply (voltage regulated power supply capable of 0.0 to 1.20 vdc) lead to J484-B and positive (+) lead to J-484-A.

(3) Apply current to indicator per figure 202, check indication, and record readings.

(4) Connect negative (-) power supply lead to J484-D and positive (+) lead to J484-C.

(5) Repeat step (3).

(6) If indicator readings are not within figure 202 tolerances, replace indicator.

NOTE: No adjustment of the dual pointer fuel flow indicator is allowed.

FUEL FLOW INDICATOR	APPLIED MICROAMPS (uA)	INDICATOR READINGS			
		REQD LBS	TOLERANCE		ACTUAL LBS
			MINIMUM LBS	MAXIMUM LBS	
L Pointer	167	500	460	540	----
	333	1000	960	1040	----
	500	1500	1460	1540	----
	667	2000	1960	2040	----
	1000	3000	2940	3060	----
R Pointer	167	500	460	540	----
	333	1000	960	1040	----
	500	1500	1460	1540	----
	667	2000	1960	2040	----
	1000	3000	2940	3060	----

Fuel Flow Indicator Tolerance
Figure 202

FUEL FLOW CONTROL BOX - MAINTENANCE PRACTICES

1. General
 A. The fuel control box is located on the lower side of the RH electrical equipment tray in the tailcone. The control box houses the fuel monitor printed circuit board.

2. Removal/Installation
 A. Remove Fuel Control Box
 (1) Lower tailcone access door.
 (2) Disconnect electrical plug from box.
 (3) Remove attaching parts and box from panel.
 (4) Remove cover from box.
 (5) Remove printed circuit board from box.
 B. Install Fuel Control Box
 (1) Insert printed circuit board in box.
 (2) Install cover and secure with attaching parts.
 (3) Install box on RH electrical equipment tray and secure with attaching parts.
 (4) Connect electrical plug to box.
 (5) Raise and secure tailcone access door.